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IS THERE CONSUMPTION RISK SHARING IN THE EEC?

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Abstract

There is a debate about the degree of consumption risk sharing existing in the EEC, and about whether the EEC should provide some specific insurance schemes. This paper introduces and develops theoretically the concept of international consumption risk sharing and presents some empirical evidence with respect to external and idiosyncratic variables in static and dynamic frameworks. We find that, although there are substantial differences across countries, the level of risk sharing is quite high in the EEC and no further institutional agreements seem to be needed in order to implement first best allocations.

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1 INTRODUCTION

The degree of international capital market integration achieved by capital flows remains a matter of debate after 20 years of the assumed internationalization of the world economies.

The importance of this issue is twofold. First of all, free capital mobility is in general a necessary condition for the efficient international allocation of world's savings. In complete competitive markets, welfare enhancing trade will take place continuously over time in response to the arrival of new information and that will induce the allocation of savings to the investments with highest returns, and the prevention of arbitrages. That may imply the departure from the equality of savings and investments that must hold in a closed economy.

Second, free capital mobility is crucial as an insurance mechanism against unforeseeable shocks. On the financial side of the economy, free capital mobility allows agents to diversify their portfolio and hence to maximize returns while minimizing risks. Purely financial transactions account for a large share of the trade in capital markets but an important dimension of trade in these markets is represented by the net exchange of financial assets for current consumption. At a national level, this exchanges will be reflected in the net capital flows in the balance of payments. Besides, capital account transactions may contribute to the international sharing of consumption risks, since they permit individual countries to smooth their consumption over time by issuing claims to overcome transitory shortfalls in domestic output or transitory increases in domestic investment, serving as the insurance mechanisms in the real part of the economy. Therefore, an economy with perfect capital mobility where the consumption risk sharing proposition will be binding, implies that individual agents, countries at a national level, will not react in response to idiosyncratic shocks, and will react to common shocks only to the extent that reacts the aggregate.

This issue of international consumption risk sharing becomes more important as the degree of integration of the economies increases. In closed economies, the international transmission of shocks is neglectable by definition, as it is in open economies where each individual country is in principle able to offset the shock through suitable policy action. In more integrated economies this may no longer be true, since the degree of policy independence may often decrease with integration. For example, in a fixed exchange rate agreement, monetary policy autonomy disappears and the scope for fiscal policy is also limited, at least in the medium term. Within a system such as the future European Monetary Union, if the market does not naturally provide it, some provision should appear in order to ensure the desired degree of consumption risk sharing and protect individual countries in difficulty since, as Sala-i-Martin and Sachs (1992) among others suggests, it may be critical for the successful implementation of a common currency.

Beyond this direct interest in the risk sharing proposition, the presence and strength of consumption insurance has methodological implications for macroeconomics and finance. Full consumption insurance implies the existence of a representative consumer, that is, a social welfare function defined over aggregates that is independent of changes in the distribution of income or wealth over time. A rejection of insurance suggests that there may be important relations between distributions of income or consumption that should be accounted for by explicitely modelling the atomistic nature of the private sector.

Reflecting the importance of the issue of international capital market integration, a huge body of literature has been developed in order to evaluate the degree of integration of the markets, applying the first two characteristics of integrated capital markets that we have examined above: the allocation of savings and investments and the comparison of rates of return and diversification of portfolios. Instead, the third characteristic, the sharing of risks in consumption, has only be developed recently at a macro level, analyzing G7 countries [1].

Here we enter the debate of whether the EU has reached the desired degree of market integration by analyzing the consumption risk sharing properties of the european space. We analyse the different approaches to the study of financial integration in Section II in order to

[1]See among others Canova and Ravn (1993) or Obstfeld (1993)

provide a framework in which to encompass our study. We will use a very simple neoclassical model without capital to derive theoretically the international consumption risk sharing proposition, that is, the equalization across countries of the marginal rates of substitution in consumption (Section III).

With the exception of Canova and Ravn(1993), the existing papers test risk sharing by computing correlation coefficients of consumption series typically without standard errors. This evidence is far from being conclusive, and in any case it can only be interpreted as contemporaneous evidence. Our empirical investigation in Section IV will try to go further and will have four parts. Given that risk sharing is widely investigated in International Real Business Cycle models, we provide correlation coefficients in order to compare with existing literature on international stylized facts. Then, we investigate our theoretically developed conditions in two setups, one static through regression analysis and one dynamic through impulse response and variance decomposition analysis in VAR systems. This will permit us to test the intuition that lies behind the risk sharing proposition, that is common responses to common shocks and no responses to idiosyncratic shocks. We also provide informal measures of average risk sharing across Europe through SURE regression coefficients and the variance decomposition analysis. Finally, we allow for the posibility of lagged risk sharing testing for Granger-causality in the VARs.

There are some results standing out from our analysis. The first one is that the degree of risk sharing is high in the EU, around 60-70% on average, but with differences across countries. We can not draw such a clear picture as them, but our results are broadly in the line of the 'core' and 'periphery' of Bayoumi and Eichengreen(1991). Belgium, Luxembourg and The Netherlands are the countries with highest degree of risk sharing and toghether with Germany, France and the UK could form the 'core' of the Union. Ireland, Portugal, Greece and Spain are the countries with less amount of risk shared within the EU. The explanation may lie in the fact that Portugal, Greece and Spain have been relatively closed countries, at least with respect to Europe, in the last 20 years, and

Ireland is perhaps more conected with U.K. than with Europe. Finally, Denmark and Italy constitute a third category that exhibits rather peculiar characteristics. Denmark appears to be an open country but that it is not sharing its risks within the EU and Italy displays such variablity that any analysis is spoiled due to the huge standard errors.

The main result of our analysis is that, given that our data includes nontradable goods, it seems from the evidence that the existing institutions and arrangements are providing a good degree of risk sharing and that no other specific implementation is needed. Likewise, the degree of market integration existing in Europe seems sufficient and no substantial welfare gains can be expected from the further opening of capital markets. However, policy measures seem to be needed to solve the structural divergences that we have found in the reactions of the different countries to the idiosyncratic variables. However, it should be stressed that this problem is to be solved through an institutional redesign and a redistribution of income and not through specific insurance programs.

2 HOW CAN WE MEASURE CAPITAL MOBILITY

Since the 1970's, the world financial markets have clearly become global. Both the widespread financial deregulation and modern communication technologies have created close linkages among the financial markets of the industrialized countries.

Capital becomes mobile between two regions if some of their residents are able to engage in inter-regional asset trades. Thus, the degree of capital mobility is measured by the scope of such trades, which will in practice be limited by transaction costs, taxes and specific regulations.

It is important to stress that the degree of capital mobility cannot be measured by total size of net capital flows, either in absolute value or relative to gross national products. Large capital flows can take place in perfectly integrated markets, as well as in segmented markets, and investment can be perfectly allocated even without any capital flow. Dornbush (1980) defines perfect capital mobility as the combination of perfect substitution of domestic and foreign bonds and the instantaneous adjustment of actual and desired portfolios. However this definition only takes into account trade in safe nominal assets whereas considering the possibility of trading risky assets, Stulz(1986) defines that capital mobility as being perfect if, in all the states of the world, all investors value identically in some given numeraire any arbitrary cash flow irrespectively of where it originates.

There have been two main approaches in the literature to the issue of determining the mobility of international capitals.

The first one is based on the direct comparison of national saving and domestic investment rates based on the fact that in a closed economy, savings and investment must be equal. Feldstein and Horioka (1980) initiated this approach based on the idea that the degree of correlation between saving and investment rates can serve as a barometer of the degree of capital mobility of an economy.

The second one, more indirect, derives from the equilibrium condition that results from maximizing utility in simple neoclassical models and are based on the comparison of either expected returns on assets or marginal rates of substitution in consumption.

2.1 DIRECT MEASURES

The difference between a country's income and its expenditure yields a direct measure of the extent to which it engages in intertemporal trade with the rest of the world. When an economy is closed, national income has to be equal to national spending. In contrast, open economies may finance discrepancies between income and spending through international borrowing and lending.

Feldstein and Horioka (1980) and Horioka(1983) initiated this approach attempting to measure these discrepancies based on the assumption that in a world with perfect capital mobility movements in domestic investments and movements in national savings will be approximately uncorrelated. Their analysis is based on regressing

$$(I/Y)_i = \alpha + \beta(S/Y)_i + \epsilon_i \tag{1}$$

on a cross-section of OECD countries. They obtained a parameter β of 0.887 and concluded that capital mobility is not perfect. This conslusion is based on the fact that the estimated value of β is interpreted as measuring the effect of a sustained increase in a country's savings rate on its investment rate, and therefore in a closed economy it should be equal to 1. However, recent research in the fields of endogenous growth and real business cycles has obtained similar values of this parameters in models with perfect capital mobility (see among many others Obstfeld(1992) or Baxter and Crucini(1993)) and therefore it is unclear that this direct relationship between savings, investments and capital mobility exists.

2.2 INDIRECT MEASURES

These attempts make use of the results of simple two-good models of international nominal interest rate differentials with risk averse investors, of the type developed by Breeden (1979) or Lucas (1978). If there is one asset in an economy with complete capital markets and representative agents, intertemporal maximization of the utility yields an equilibrium condition

$$E_t[Q^i_{mt+1} R^j_{t+1}] = 1 \tag{2}$$

where R is the return on the asset and Q the marginal rate of substutition of money, and it has to hold for every asset traded (j) and for every consumer (i).

2.2.1 Rates of return-based tests

Setting i fixed, a representative agent in Spain, for example, we may use equation 5 to empirically analyse the degree of capital mobility by comparing the yields on equivalent assets in different places.

The most straightforward approach would be the direct comparison of rates of return on physical capital in different countries. Although there have been some attempts (Harberger, 1978), the problems of measurement or different tax treatment make it very difficult to compare it properly. Hence, most research has gone to a more restrictive group of homogeneous financial assets, and even here the different taxation of interest payments may include some biases in the results.

We should notice that if we make the comparison between assets traded in different currencies but in the same place (for example, London Eurocurrency deposit rates) we test the forward foreign exchange premium instead of the degree of capital mobility. Hence, the relevant variables to use would be nominal yields on "on-shore" and "off-shore" assets denominated in the same currency. These rates generally do differ, quite expectably if you take into account cross-country heterogeneity as measured by default, sovereign and political risk, capital controls and other financial regulation. Frenkel(1993) reports tests for a wide range of industrialized and developing countries for the period 1982-1988, concluding that in general short-term covered interest differentials were small and hence that there seems to be a substantial degree of capital mobility among OECD countries that has increased since the early 70s (see also Obstfeld, 1986b).

However, despite the fact that real world markets are assumed to be quite integrated, several studies have found that the portfolios of developed countries are biased towards domestic assets(e.g. Golub, 1991 and Tesar and Warner, 1992), that there are predictable excess returns (Solnik, 1991a) and there is a vast room for diversification in the financial markets (e.g. French and Poterba (1991) or van Wincoop (1992)). The have been several explanations to that apparently irrational behavior, that may include the existence of nontradable goods (Stockman and Dellas, 1989), the differences in relative risk aversion across countries (Canova and Ravn (1993)), the existence of frictions such that transaction costs or taxes that may wipe out the benefits from diversification (Cole and Obstfeld (1991) and Obstfeld (1992)) , or the presence of informational costs about the future payoffs of international investments (Backus and Kehoe, 1992) or particular investor choices (French and Poterba, 1991). [2]

2.2.2 Consumption-based tests

So far we have examined the existence of risk sharing using tests based on financial variables. But we can also fix j in equation 2 and set the test for the same asset for representative agents in different countries. This will lead us to consumption-based tests which examine countries participation in world financial markets.

This implies that the emphasis of risk diversification can be shifted from financial to real variables, and this brings us to the issue of international consumption risk sharing. Complete insurance implies that the consumption of agents will not vary in response to idiosyncratic shocks while risk diversification in financial markets implies that the value of a well diversified portfolio will not vary due to an idiosyncratic shock to a particular currency. Cochrane (1991) defines perfect risk sharing as the cross-sectional counterpart of the permanent income hypothesis, since the latter implies that the consumption of an individual will not vary over time in response to idiosyncratic transitory shocks.

You will find full consumption insurance if financial markets are complete or there are a set of institutions making the role of a central planner implementing Pareto optimal allocations. However, even when financial markets are not complete, Pareto optimal allocations can be obtained if there is continuous trading of a few long lived securities (Duffie and Huang, 1985). Also, you could achieve close to full consumption insurance without complete markets or institutional intervention as long as agents have similar preferences and differ only on their income stream (Baxter and Crucini (1992) and Marcet and Singleton (1992)).

[2] So far we have compared nominal interest rates. No much has been done about real interest rates, since the underlying theory is based on very strong assumptions which are very difficult to accept in practice: uncovered interest parity and purchasing power parity, which are always rejected in empirical tests (see, for example, Cumby and Obstfeld (1984) and Cumby and Mishkin (1985)).

Theoretical analysis of these issues appear in several kind of models and with different treatments. In models of closed economies with income heterogeneity across agents (Mace, 1991) or related to the issue of precautionary savings (Guiso and Jappeli (1992)). It arises also with open economies, where countries with heterogeneous income streams trade internationally in order to avoid country specific risks and only bear aggregate world-wide risk (Brennan and Solnik (1989), Backus, Kehoe and Kydland (1992) or Ravn(1993)). Finally, it arises also in endogenous growth models (Obstfeld (1992)).

Empirical analysis of international consumption risk sharing generally reaches the conclusion that markets for risk function imperfectly at the international level, and certainly less efficiently than they do at domestic or individual level. Atkeson and Bayoumi (1992), for example, argue that the national diversification of regional incomes within the United States is significantly greater than the international diversification of European national incomes. Other examples along these lines could be Van Winkoop (1992), who examines the degree of risk sharing evident in Japanese regional consumption data or Sala-i-Martin and Sachs (1992) who present evidence on the amount of risk borne by the central institutions in the United States. This fact of imperfect risk sharing is specially true for less developed countries, where both institutions and markets are less developed and where the access to international capital markets is more problematic, implying lesser borrowing opportunities for reasons of moral hazard and country-specific risk.

With an international dimension, Canova and Ravn(1993), Obstfeld(1993) and Lewis (1993) have all studied the degree of risk sharing on samples of OECD countries, concluding that the level of risk sharing has increased since 1973 but is still less than perfect. The basic message of all these works is that correlations among international consumption movements are too low to be fully explained with a model with free international asset trade and complete markets, remaining, in the words of Backus,Kehoe and Kydland (1993), one of the most presssing puzzles of the international business cycle framework.

Given this empirical evidence on imperfect risk sharing, other approaches have tried to measure the welfare loses due to imperfect risk sharing (Breenan and Solnik (1989) and Obstfeld (1992)), analyse moral hazard issues as the reason of imperfect risk sharing (for example in less developed countries where there is credit rationing and risk of repudiation (Atkeson (1991)) or in cases where insurance is directed to country specific shocks, say, moral hazard problems manifested in labor militancy when the cost of unemployment benefits is shifted from national to federal taxpayers (Eichengreen(1991))) or set up the conditions necessary for insurance schemes (differentiating between insurance and redistribution (Melitz and Vori (1992))) and institutions to implement the desired degree of risk sharing (Persson and Tabellini (1992)).

3 A simple theoretical model

Following an Arrow-Debreu approach we will cast the risk sharing problem in the setting of a world social planner. Since we have a model without distorsions, the outcome will be equivalent to the competitive equilibrium. The planner will maximize the weighted sum of expected utilities of the agents subject to an aggregate resource constraint. An optimal resource allocation will imply a distribution of aggregate endowments that equalizes weighted marginal utilities across agents.

In particular, this world social planner faces the problem of maximizing the utility of the representative consumer of J countries when there is only one aggregate consumption good and perfect trade in a complete set of state-contingent assets.

The information structure of the economy is represented by $s_{\tau t}$, $\tau = 1, 2...S$, where each $s_{\tau t}$ is an event that represents all common information at time t and collects all states of the world. S is finite, $\pi(s_{\tau t})$ is the probability that event τ occurs at time t and $\sum_{\tau=1}^{S} \pi(s_{\tau t}) = 1, \forall t$.

The expected lifetime utility of the representative consumer in country j is expressed as:

$$\sum_{t=0}^{\infty}\beta^t\sum_{\tau=1}^{S}\pi(s_{\tau t})U[C_t^j(s_{\tau t}),b_t^j(s_{\tau t})] \tag{3}$$

where $C_t^j(s_{\tau t})$ is the consumption of the agent of country j at time t and event τ, $0< \beta < 1$ is the discount factor common to all agents and $b_t^j(s_{\tau t})$ represents a preference shock, that may include all factors different from market consumption that can enter the agent's utility function, like leisure, government expenditure, non tradables, household production and the like.

Each country is endowed with a stochastic amount of the good at each t, $y_t^j(s_{\tau t})$. The stochastic nature of the endowment can be represented as $y_t^j(s_{\tau t}) = y_t^j + \mu_t^j(s_{\tau t}) + \epsilon_t^j(s_{\tau t})$, where y_t^j represents the deterministic component, $\mu_t^j(s_{\tau t})$ represent the effect of an aggregate shock and $\epsilon_t^j(s_{\tau t})$ represents the idiosyncratic shock. Aggregating over the j countries, $y_t^a(s_{\tau t}) = y_t^a + \mu_t^a(s_{\tau t})$, since we assume that $\epsilon_t^a(s_{\tau t}) = 0$ for all events and points in time. The wealth of each country is represented by Π_j and the population by χ_j (we will assume that the population and wealth of the countries will not change with time) and $\sum_{j=1}^{J}\Pi_j = \sum_{j=1}^{J}\chi_j = 1$.

Therefore, the world social planner will maximize the weighted sum of the expected utilities of the J countries, given by equation (4) by determining an allocation of consumption across countries subject to the aggregate resources constraint, equation (5):

$$\max_{c_t^j}\sum_{j=1}^{J}\Pi_j\sum_{t=0}^{\infty}\beta^t\sum_{\tau=1}^{S}\pi(s_{\tau t})U[C_t^j(s_{\tau t}),b_t^j(s_{\tau t})] \tag{4}$$

$$\sum_{j=1}^{J}\chi_j C_t^j(s_{\tau t}) = \sum_{j=1}^{J}\chi_j y_t^j(s_{\tau t}) \tag{5}$$

for all events and dates, where $0< \Pi_j < 1$ and $C_t^j(s_{\tau t}) > 0\ \forall j$. The first order conditions for that problem can be expressed as:

$$\frac{U'(C_t^i(s_{\tau t}))}{U'(C_t^k(s_{\tau t}))} = \frac{\frac{\Pi_k}{\chi_k}}{\frac{\Pi_i}{\chi_i}} \tag{6}$$

for any i and k, where $U'(C_t^i(s_{\tau t})) = \frac{\partial U}{\partial C_t^i(s_{\tau t})}$. Hence, the aggregate endowment is distributed across countries such that the weighted marginal utilities are equated across countries.

Using logarithms, the above expression can be written as:

$$\log U'(C_t^i(s_{\tau t})) - \log U'(C_t^k(s_{\tau t})) = \xi_{ik} \tag{7}$$

where $\xi_{ik} = \log\left(\frac{\Pi_k}{\chi_k}\right) - \log\left(\frac{\Pi_i}{\chi_i}\right)$,or alternatively

$$\log U'(C_t^i(s_{\tau t})) - \log U'(C_t^a(s_{\tau t})) = A_i \tag{8}$$

where $U'(C_t^a(s_{\tau t})) = 1/j \sum_{j=1}^{J} U'(C_t^j(s_{\tau t}))$ and $A_i = \log\left(\frac{\Pi_k}{\chi_k}\right) - \log\left(\frac{\Pi_a}{\chi_a}\right)$. Equation (7) implies that, apart from a scale factor, the marginal utility of consumption of any two countries must be equalized. Instead, equation (8) states that the marginal utility of consumption of country i is proportional to the marginal utility of average world consumption, holding both propositions for all countries j, all states τ and all periods t. It is important to note that while both implications are not different, the averaging procedure makes the second one be less stronger than the first and hence if equation (7) holds then equation (8) will hold as well but the reverse is not true.

For all those conditions to be valid, we should select a HARA utility function (see Breenan and Solnik(1989)). Among these we will choose a CRRA specification because (see King, Plosser and Rebelo (1988)) is compatible with balanced growth. Specifically, the utility function is

$$U[C_t^j(s_{\tau t}), b_t^j(s_{\tau t})] = \left(\frac{1}{1-\sigma_j}\right)((C_t^j(s_{\tau t}))^{\eta}(b_t^j(s_{\tau t}))^{1-\eta})^{1-\sigma_j} \text{ if } \sigma_j \neq 1 \tag{9}$$

$$U[C_t^j(s_{\tau t}), b_t^j(s_{\tau t})] = \eta \log C_t^j(s_{\tau t}) + (1-\eta)\log b_t^j(s_{\tau t}) \text{ otherwise} \tag{10}$$

where σ_j is the coefficient of relative risk aversion of country j and η is the elasticity of substitution between $C_t^j(s_{\tau t})$ and $b_t^j(s_{\tau t})$.

With the above specification of the utility function, equations (7) and (8) become

$$\log C_t^i - \alpha_{ik} \log C_t^k + \rho_{ii} \log b_i - \rho_{ik} \log b_k = \xi_{ik} \tag{11}$$

and

$$\log C_t^i - \alpha_{ia} \log C_t^a + \rho_{ii} \log b_i - \rho_{ia} \log b_a = A_i \tag{12}$$

where $\alpha_{ik} = \frac{\eta(1-\sigma_k)-1}{\eta(1-\sigma_i)-1}$ and $\rho_{ik} = \frac{(1-\sigma_k)(1-\eta)}{\eta(1-\sigma_i)-1}$.According to these expresions, the consumption of country i net of taste shocks will be higher or lower than that of country k depending on the sign of ξ_{ik},which represents the differences of the logs of per capita wealth. Hence, countries with higher (lower) wealth per capita will consume more (less). And the same happens regarding the share of each country in aggregate consumption (equation (12)).

Taking the first difference of the equations, we may express the international consumption risk sharing proposition in terms of the rates of growth of consumption:

$$\Delta \log C_t^i = \alpha_{ik} \Delta \log C_t^k - \rho_{ii} \Delta \log b_i + \rho_{ik} \Delta \log b_k \tag{13}$$

$$\Delta \log C_t^i = \alpha_{ia} \Delta \log C_t^a - \rho_{ii} \Delta \log b_i + \rho_{ia} \Delta \log b_a \tag{14}$$

Since they are time invariant, the welfare weights are removed with the diffferences. The implications of these equations are that the rate of growth of consumption of country i net of preference shocks will comove with that of country k and with that of the aggregate. Hence, in a perfect risk sharing enviroment idiosyncratic shocks will not affect the consumption stream of individual countries and aggregate shocks will affect them only to the extent that the shocks affect the aggregate. An uneven response of a country to a common shock will be then evidence of imperfect risk sharing.

We should note that we have made some important assumptions in our model. First of all, we have assumed representative agents in each country, and hence that there is already perfect risk sharing within each country. Second, our specification of the utility function assumes time and state separability. Third, we have assumed perfect information and complete asset markets. However, some of these problems have been already treated in the literature. Mace(1991) analyze the risk sharing conditions for exponential and power utility functions whereas Canova and Ravn (1993) extend it to issues like habit persistence, durability, more than one good traded, leisure or heterogeneous countries. Included in international real business cycle models, Ubide(1994) studies the implications of the risk sharing proposition when home production is included in the utility function of the agents, Deveraux, Gregory and Smith (1992) introduce leisure choices in a non-separable way and Tesar (1993) analyse the introduction of nontradable goods. In all the cases, the only difference will be that more elements will appear in the right hand side of equations 13 and 14, like elasticities of substitution (for nontraded goods or government spending) or leisure and productivity profiles (for leisure).

4 EMPIRICAL IMPLICATIONS

This section describes the results of our empirical analysis.

The empirical investigation will follow four steps. The risk sharing issue has widely arosen in RBC models, since these models predict in general a high degree of risk sharing, that means corr(C,C*)=1 when C* is the consumption of the foreign country, whereas the coefficients obtained with actual data are substantially lower. Hence, in a first step we will compute cross-country correlation coefficients of consumption series in order to determine the degree of risk sharing in that sense. Newey-West consistent standard errors will inform us of the statistical significance of the point estimates.

In a second step, recasting the theoretical implications of risk sharing represented by equations (11) and (12), we get

$$\Delta \log C_t^i = \beta_1 \Delta \log C_t^a + \beta_2 \Delta \log \ b_t + \epsilon_t \tag{15}$$

and in the case of perfect risk sharing the hypothesis $H_{0:}$ $\beta_1 = 1$ and $\beta_2 = 0$ should not be rejected. The predictions of these equations are that, regressing national consumption on aggreate consumption and any other right hand side variables that could affect national consumption, all variables other than aggregate consumption are predicted to enter insignificantly. This reflects that fluctuations in national consumption responds to aggregate risks but not to idiosyncratic risks. The right hand side variables will be both common and idiosyncratic variables.

All ther previous analysis are contemporaneous static implications of the risk sharing proposition. However, the intuition that lies behind the theory is in some sense dynamic, since we talk about the responses of national consumption to different shocks. We attempt to introduce this intertemporal dimension through the analysis of the impulse response functions in VAR systems of each national consumption toghether with common or idiosyncratic shocks. With this instrument we will be able to test the implications of equations (11) and (12), determining whether the response of domestic consumption to a common shock in two different countries are similar and whether the response of a country is similar to that of the aggregate. Likewise, we will study the response of national consumption to different idiosyncratic shocks and check, as predicted by the theory, that those responses are not significantly different from zero. Then, the variance decomposition analysis will inform us on the degree of risk sharing in this dynamic framework.

Finally, one further issue will be explored. The are countries that effectively share their risks within an aggregate but that systematically do so with some lag due to the particular structure of their economy (Spain, for example). The VAR setting allows us to test this implication through Granger-causality tests, since the prediction of the theory will be then that current and lagged exogenous variables should not help in predicting the behaviour of national consumption. Hence, we will test for Granger causality in the VARs, expecting that the exogenous variables will not Granger-cause national consumption.

4.1 Data analysis

The issues of capital markets integration and international consumption risk sharing has been to some extent developed and tested for the main OECD countries, but it has not been applied and tested for the European Community as a whole, despite the fact that it may become extremely important for the future implementation of a common currency at the third stage of the EMS. That has lead us to set up the tests with data from the twelve countries of the EU, in an attempt to discover the peculiarities of these groups of countries.

The data has been obtained from DATASTREAM, and measures annual per-capital total aggregate consumption data in 1985 prices from OECD Main Economic Indicators for the period 1960-1990 (see Data Appendix). The main difficulty we face when working with EU data is that quarterly data i sonly available for France, UK, Germany and Italy (in fact this is the reason why all the empirical tests of the theory have been done with G-7 data, since you can obtain quarterly data for all of them). But given the usually low quality of consumption data, it is more likely to find noise in quarterly than in annual data. Besides, Christodulakis et al. (1993) have analysed the stylized facts of the EU both annual and quarterly data and concluded that there is no significant difference between the two specifications. We should also note the impossibility of obtaining disaggregated series on consumption of tradables, a more convenient variable for our analysis than total consumption. But different dissagreggation methods across countries could have introduced distortions into the analysis. Hence, we offset the fact that the series are short and include nontradables with supposedly a better quality and homogeneity of the data.

Consumption series are usually non stationary series. Our model has an implicit detrending procedure, since we will be working with the first difference of the series. It is important to note that different detrending methods leave cycles of different lengths in the data (see Canova

(1991)). First Order Differencing leaves in the data cycles of 2-3 years while, for example, Hodrick-Prescott filtering, leaves cycles of 5-6 years. This can be important when interpreting the results of our analysis because short term divergences will be always easier to insure than longer ones.

4.2 EMPIRICAL RESULTS

4.2.1 Correlation analysis

We start the analysis using the simplest tool that we have available, the correlation structure of the series. Unless otherwise stated, the standard errors are Newey-West consistent standard errors computed with 10 lags.

Table 1 displays the correlation matrix of the rates of growth of consumption for the twelve countries. The values range form zero (non significant) to 0.55. The mean values for the countries go from 0.19 for Denmark to 0.44 for Belgium. Denmark is the country with less significant coefficients, (it is only significantly correlated with Luxembourg), together with Portugal and Spain, that are only correlated with two and three countries respectively. Belgium, The Netherlands, The U.K., Ireland, France and Germany seem to be well correlated amongst themselves and Luxembourg remains in an intermediate position. Italy, Greece, Spain and Portugal seem to form another group as well.

Table 2 displays the correlation matrix of each country with a composite variable called EU, constructed as a weighted average of the values of each country, using as weights the share in EU GNP of each country, and with the external shocks. This composite variable is significantly correlated with consumption in Belgium, Netherlands, Italy, Greece and Spain. We have to be careful in interpreting these results, since the composite variable is an average of the 12 countries of the EU. That means that the bigger countries are more likely to present higher correlations, and the countries with significant more variability will contribute decisively to the variability of the composite variable, and that will be also reflected in the correlations. This can be the case, for example, of Italy, which shows a standard deviation of 0.083 whereas the rest of the countries show values around 0.02-0.03. That may imply that the significant correlations with the EU may only be really significant for our interpretation in the cases of Belgium and Netherlands, and perhaps in the case of Greece, since Italy and Spain are relatively large countries which display a high degree of variability.

4.2.2 Regression analysis

Recalling the theoretical implications of the international risk sharing proposition, we will estimate eq.(15). The aggregate consumption variable will be the composite variable representing the rest of the EU for each country, that is, we exclude now the country from the composite EU in order not to overestimate the coefficient. The other right hand side variables will be: U.S. consumption, U.S. GNP, U.S. short term interest rates and oil prices as common external variables. For each country we will also consider population, rate of inflation, personal income (proxied by GNP per capita) and government consumption. Therefore, we will estimate for each country eight regressions, one for each right hand side variable, and we will test two hypotheses:

$H_0 : \beta_1 = 0$ so no risk sharing occurs

$H_0 : \beta_1 = 1$ and $\beta_2 = 0$, so that markets are completely integrated

But we have n observations over time in m equations for different cross section units. That implies that the residuals of this equations may be contemporaneously correlated across units. Therefore, using a SURE procedure seems the most adequate approach to use. The results appear in tables 3 and 4.

Regarding the case of common external variables, the hypothesis of $\beta_1 = 0$ is only accepted for Denmark, Germany and Italy. Conversely, the hypothesis of $\beta_1 = 1$ is only accepted for Italy, Greece, Netherlands, Portugal and Spain. For the external variables, $\beta_2 = 0$ is only rejected for two countries, Denmark and U.K. Finally, the joint hypothesis is tested with an F-test. Ireland, Italy, Greece, Netherlands, Portugal and Spain are the only countries that accept the hypothesis of perfect risk sharing. However the interpretation of this results should be done carefully. Italy is by far the country with the highest variability in the series. This has the implication of higher standard errors and hence β_1 is accepted to be both 0 and 1. Greece, Portugal and Spain have been traditionally countries with quite closed markets, and therefore it seems strange that these are the countries with more integrated markets. The explanation may be that the hypothesis of risk sharing could be accepted in the extreme case of autarky. Given that consumption depends on income, if two autarkic countries suffer from a common shock to income, their consumption streams will move relatively together even if the markets are closed. In that case, we could distinguish autarky form risk sharing by checking the relationship between national consumption and national income. If the latter is strong, the previous results could indicate a high degree of closeness of the economies. Finally, The Netherlands and Ireland seem to be the only countries with a high degree of risk sharing with respect to common external variables. The Irish case could also be tricky, since Ireland is a country that trades mainly with the U.K. The U.K. is a big country and has an important weight in the composite variable used in the regressions of Ireland. Therefore, it may be the case that Ireland is not sharing its risks within the EU but with the U.K. Denmark and Germany are the countries that seem not to share any risk at all within the EU. This is not necessarily a sign of closeness of the markets, it may imply the existence of trade relationships out of the EU, with Nordic or Eastern European countries, for example.

Regarding idiosyncratic variables, again Denmark and Germany are the only countries that accept the hypothesis $\beta_1 = 0$. Population enters significantly for Belgium. Portugal and France, inflation and government spending enter significantly in the equations of some countries but by far is personal income the variable that is more important across countries, being insignificant only for Denmark, Germany and the U.K. The F-test (tables 5 and 6) shows similar results as before regarding the countries: France, Italy, Greece, Netherlands, Portugal, Spain and U.K. are the countries that accept the hypothesis of perfect risk sharing for some of the variables. Population, inflation and government spending seem to be well insured, but personal income is only insured by Netherlands. Hence, our previous hypothesis seems to be correct, since Greece, Portugal and Spain depend significantly on national income, confirming the intuition of closeness instead of openness. Italy, France, Netherlands and U.K. are the only countries that have shared idiosyncratic risks to some extent within the EU. Belgium, Ireland and Luxembourg show some risk sharing which, however, is not perfect, and Germany and Denmark appear to be the countries that are more independent of the EU.

If we estimate both systems under the restriction of equality of coefficients, we obtain the following parameter estimates

USC	USG	USi	PP	POP	INF	INC	GOV
0.61	0.60	0.62	0.64	0.54	0.25	0.23	0.37
(0.06)	(0.07)	(0.06)	(0.02)	(0.04)	(0.09)	(0.08)	(0.10)

These parameters may be interpreted as the 'average risk sharing' across Europe with respect to each of the variables. The average of these parameters, 0.48, could then be interpreted as the average fraction of risk that the members of the EU are pooling inside the EU.

All empirical studies dealing with risk sharing have found an increase in the degree of markets integration from 1973 onwards (see Obstfeld(1993), for example). This fact has been checked computing the previous correlations for the subsample 1973-1990. The second row of Table 2 shows the values of the correlation coefficient of each country's consumption with the composite variable for the subsample 1973-1990, and we can see that now all the coefficients are significant, whereas for the whole sample only five countries were significantly correlated with the composite .

In order to determine the evolution of that increase in the correlations we have computed recursive correlation coefficients of each country consumption with the aggregate, starting in 1972. Figure 1 displays the time value of this coefficients for the period 1972-1990. The main conclusions that can be drawn from this picture is that there is a break in the behavior of the majority of the countries around 1972-76 that probably reflects the different impact of the oil crises in the different European countries and after this break, around 1980, the coefficients stabilize being more or less grouped at the end of the period.

A further confirmation of the latter fact is to check the variability of the series in the two subsamples. If risk sharing occurs more integrated markets should display less variability. The following table shows the percentage standard deviations of the series for the two subsamples, and in all the cases except for Denmark, Ireland and Portugal the the distance test reveals that the coefficient has decreased [3]

	B	D	F	G	IR	IT	GR	LU	NE	PT	SP	UK
$S.D.$	1.8	3.7	2.4	2.5	3.7	8.3	3.3	2.8	3.1	4.1	4.4	3.0
$s.e.$	(0.1)	(0.2)	(0.1)	(0.1)	(0.2)	(0.5)	(0.2)	(0.2)	(0.3)	(0.3)	(0.3)	(0.2)
$S.D.$	1.5	3.5	2.1	2.0	3.5	3.6	2.9	2.3	2.2	4.4	3.0	2.0
$s.e.$	(0.1)	(0.2)	(0.1)	(0.1)	(0.2)	(0.2)	(0.1)	(0.1)	(0.1)	(0.3)	(0.3)	(0.1)
$d.t.$	3.90	0.51	4.51	12.5	0.54	24.5	2.01	2.04	8.12	0.05	10.88	5.55

Finally, if we now repeat the regression for the subsample 1973-1990, the F-test is accepted for many more countries (tables 5 and 6).With respect to external variables, Germany in now the only country rejecting in all the cases the risk sharing hypothesis and countries like France or Belgium that rejected before now accept in all the cases. The same happens with respect to the idiosyncratic variables, and now even Germany accepts the risk sharing proposition for population and government spending. Hence, it seems that both the general opening of the markets and the process of integration in Europe has contributed to some extent to the pooling of consumption risks in the EU. However, we still find some differences across countries.

4.2.3 VAR ANALYSIS

We have stated before that under full consumption risk sharing the response to common external shocks should be the same across countries and the magnitude of the response broadly similar among the group of countries. If a country is hit by a common shock but not another we

[3] The first row are the values for the whole period 1960-1990. The second are the values for the subsample 1973-1990). The third row are the values of a distance test. The critical value for the hypothesis of equality of coefficients at 95 % is a $\chi(1)$:3.78

have a clear example of a situation in which risk has not been pooled. Thus, we could summarize the intuition that lies behind the risk sharing proposition as no response to idiosyncratic shocks and similar responses to common shocks. This intuition is in some sense dynamic, since we are talking of shocks today and its effect in the future, and therefore it seems that the static regression analysis may not be enough to fully test the risk sharing conditions of a group of countries. Hence, we will introduce these dynamics through the study of the responses of consumption in each country to common and idiosyncratic shocks.

The shocks are computed as the first differences of the series. We have selected as shocks the same variables as before in order to compare the results.

The external shocks are: U.S. consumption, U.S. GNP, U.S. interest rate and oil prices. We have selected the U.S. because of its importance in the world economy. U.S. consumption will allow us to determine the degree of risk sharing and hence of capital mobility between Europe and the U.S. U.S.GNP and interest rate are selected in order to introduce the effects of U.S. economic policies. Oil prices are included because the European economies are still in general highly dependent on oil imports.

With a similar criteria, we have selected idiosyncratic shocks so as to cover different sources of shocks that may occur in the real economies: national population, inflation rate, government spending and GNP per capita. A better variable to be used for fiscal shock would have been government deficit, but we could not find sufficient good data to construct it. Even the government spending series were not available for Luxembourg.

We will set two VARs for each country, each containing national consumption and one of the vectors of shocks, S_t^c with the common shocks and S_t^i with the idiosyncratic shocks. Therefore, we will estimate for each country and each vector of shocks

$$X_{t+1}^j = B(L)X_t^j + \epsilon_{t+1}^j \tag{16}$$

where $X_t^j = [\Delta \log C_t^j, S_t]$ and we will set L=2. We will compute the impulse response functions and check the following conditions: with respect to the common shocks, we will determine how is the response of the aggregate and then we will compare the responses of each country with the rest of the countries and with the aggregate, since we are expecting common responses to common shocks. With respect to idiosyncratic shocks, we will check whether the responses of each country are significantly different from zero, since we are expecting no response to idiosyncratic shocks. In order to be able to say that a response is different from another one we need the standard errors of this impulse response, that are computed with the method of Lütkepohl (1991).

Common external shocks Figures 2,3,4 and 5 show the orthogonalized responses over ten periods of each of the countries and the composite variable EU to the external shocks, and our goal will be double: we have two conditions, the first one that the responses of any pair of countries will be equal and second, less strong due to the averaging procedure, that the response of each country will be equal to the response of the composite variable.

The following panel summarizes the information contained in Figs. 2,3,4 and 5 analysing whether the individual responses are similar on the basis of its statistical significance/non significance and, when significant, on the sign and period (i.e. +3 means that the impulse response is significantly different from zero three periods ahead).

	eu	*b*	*d*	*f*	*g*	*ir*	*it*	*gr*	*lu*	*ne*	*pt*	*sp*	*uk*
usc		-3	$+2-3$			$+2$	$+2$			$+2$			$+2$
usg		-2			-2		$+2$		-2				-2
usi	$+4$	-1		$-2+3$		$+4$	$+4$	-2				-2	
op	-3		$+2$				$+2$	$+2$	-3			-2	

To the U.S. consumption we find negative responses in the third period for Belgium and Denmark and positive responses in the second period for Denmark, Netherlands, Italy, Ireland and the U.K. To U.S. GNP Belgium, Germany, Luxembourg and the U.K. react negatively also in the second period while Italy reacts positively. Belgium, France, Greece and Spain display negative responses while EU, France, Ireland and Italy show positive responses to U.S. interest rates. Finally, EU, Denmark, Italy, Greece, Luxembourg and Spain have significant responses to oil prices.

In order to compare the responses of each of the countries with those of the aggregate, Figs. 6,7 and 8 show the two standard error bands of the impulse response of each country together with that of the EU to each of the shocks. In the case that the bands show no point in common at some time, we could establish that the responses are different at that time. The result is that only Denmark and Greece present this divergence, in the case of the impulse response to the oil price shock. It is also noticeworthy that the standard error bands of Italy are very wide, and hence the response may be very different.

This problem may be overcome with the study of the forecast error variance decomposition. This informs us on the percentage of variance of the forecast error of a given variable that is due to each of the other variables. The percentage of the variance that is not explained by the shocks could be interpreted as the 'degree of risk sharing' of each country in this dynamic framework. We can check that on table 7, where we have the variance decomposition of consumption in each country after ten periods. We can see that the percentage of variance not due to external shocks is similar across countries, around 60 %, while Portugal and France are the less affected countries, with 83 % and 78 % respectively.

Idiosyncratic shocks The first implication of the risk sharing proposition was that the response to a external shock should be equalized across countries. The second implication is that the response of each country to idiosyncratic shocks should be zero once we have taken into account the effect of this shock on the aggregate. Intuitively this occurs because if a country has diversified its risk it is hedged against any idiosyncratic shock not suffered by the group with which the pooling of risks occur. Hence, we test this second implication of the theory studying the response of each country to national shocks .

When we look at the impulse responses (Figs.9,10 and 11), summarized in the following table,

	eu	*b*	*d*	*f*	*g*	*ir*	*it*	*gr*	*lu*	*ne*	*pt*	*sp*	*uk*
pop						+3					+3		
inf			+2	−2				+2		−2			+2
inc				−3		−2	−3	−2					
gov				+2		$+2-3$	+3	+2					

population shocks generate significant responses in consumption for Ireland, and Portugal, positive in the third. Inflation shocks generate significant consumption responses for Denmark, Greece and U.K. (positive in the second period) and France and Netherlands (negative in the second). Personal income shocks affects per capita consumption in Ireland and Greece in the second period and France and Italy in the third. Government affects also France, Ireland, Italy and Greece. Therefore we find that countries with different structures react differently and in different periods, but again significant responses are concentrated in the so-called 'peripheral' countries. The comparison of each country 2 s.e. band with that of the EU (Figs. 12,13 and 14) says that Denmark, France, Ireland, Greece and Portugal are the only countries that present responses different from the aggregate one.

The variance decomposition analysis confirms our results (Tab. 7). Around a 70 % of the variance is not explained by the shocks. Greece, Ireland and Portugal show the lowest values while Germany, Luxembourg and Spain show values greater than 80 %.

In summary, we can state that around a 60 % of the common shocks and a 70 % of the idiosyncratic shocks that affect the European economies are shared within the EU.

4.2.4 Granger-causality

As we have stated before, incorporating the lag structure of the VARs allows us to test whether past and present values of the external variables help in predicting the behaviour of consumption series and hence allow for countries that react systematically with some lag. As it should be clear, we expect that no idiosyncratic variable should help in predicting domestic consumption and that external variables should help only to the extent that they help to predict aggregate consumption. In table 8 we present the results of Granger causality tests both on individual variables and on the block of exogenous variables.

Regarding external shocks, all the countries except France and Portugal reject the block-noncausality hypothesis. In particular, Spain and Greece reject noncausality for all the variables, and it seems that this is a way to overcome the difficulty to distinguish between perfect risk sharing and autarky. Relatively closed countries will react to common external shocks with some lags, and hence the static regression analysis will clearly fail to reflect this feature. Portugal is still showing noncausality to external variables but, given that even incorporating the lag structure it still react to idiosyncratic variables (see the second panel of table 8), we may conclude that Portugal is the closest country of the panel under study.

Regarding idiosyncratic shocks, France, Ireland and Greece seem to be the most affected whereas Luxembourg, Netherlands, Italy, Germany and Belgium are the countries that pass the test of block noncausality.

We can summarize our empirical results in the following points. First, there is a high degree of risk sharing among European countries, about a 60-70 % of the risks are shared within the EU. This is a quite high number if we take into account that we have included nontradables in the data, and hence sharing cannot be perfect. This sharing property has increased from 1973 and its stronger among the older members of the EU, what may imply that the European unification process has contributed to the diversification of risks.

However, we can identify two groups similar in some sense to the 'core' and 'periphery' of Bayoumi and Eicheengreen (1991)). The 'core' would be composed by the Benelux plus Germany, France and perhaps U.K. Then, Ireland, Portugal, Spain and Greece would form the 'periphery', a fact that is not surprising given the historical and economic characteristics of these countries. We have seen that Portugal, Greece and Spain have an 'autarkic' behaviour and Ireland is perhaps more linked with U.K. than with Europe. Denmark is an special case, because being an open country it does not show a high relationship with Europe, being perhaps the reason its close links with the Scandinavian countries. Finally, Italy should belong to the 'core' according to the different empirical tests, but the huge volatility of its consumption series creates very big standard errors that may create misleading results. If we interpret high volatility as an indicator of closeness of a market, we could perfectly include it into the 'periphery'.

Third, the exogenous variables that have the greater influence on the cyclical properties of the countries are US interest rates, oil prices and government spending. Oil prices is not a surprising result given the strong general dependence of the economies on oil products. US interest rates reveal the fact that during all these years the US have dominate the capital markets and in some sense determined some economic policy decisions in European countries. We suspect that from the 80's onwards this role has been played in Europe by Germany and that in order to repeat this analysis for the last 10 years it would more correct to use German interest rates. Finally, the fact that government spending has an importance in explaining cyclical fluctuations is explained by the dimension of public sectors in the European economies and the proliferation of public insurance schemes.

Our results are consistent with those of Canova and Ravn (1993), Obstfeld (1993) and Lewis(1993) in that they find substantial degrees of risk sharing, specially in Europe, increasing form 1973. We are also in the line of real business cycle theorists since we find that consumption correlations are significantly different from one (see, e.g. Ravn (1993)) and that government expenditure has a significant effect over the business cycle (Christiano and Eichenbaum (1992)).

5 CONCLUSIONS

Concluding, we have seen that, in a world of representative agents with open markets, international consumption risk sharing would be one of the main characteristics even without complete capital markets. Our empirical investigation has analyzed both static and dynamic implications of the theory with respect to a wide range of possible shocks that may affect the economies.

Regarding the results, we can say that there is a high degree of risk sharing within the EEC, increasing since 1973, but that it is far from being complete, not only due to market imperfections but also to the structural particularities of the different economies. These differences may also be related to national institutions and policy stances, and common institutions and policies should be directed to narrowing these gaps. Moreover, the most important exogenous variables seemed to be government spending, oil prices and US interest rates. These findings may indicate how public policies can be reformulated in order to minimize the effect of these variables.

We have also found some distinction between the 'core' and the 'periphery' of the EEC that, in agreement with Bayoumi and Eicheengreen, suggest the EEC as a whole is not ready yet to form a common currency area, since there are still significant differences in the structure of the economies. Ireland, Greece, Spain and Portugal, that exhibit important divergences with respect to the rest, and Italy, that shows a kind of 'overshooting' in the responses, may be the countries that would belong to that 'periphery', and these were in fact among the countries that suffered most in the recent EMS crises.

However, given the fact that we have included nontradables in our series, the degree of risk sharing that exists now in Europe seems high enough, at least in the short term. This means that new institutions intended to increase the efficiency of the markets in the line of Persson and Tabellini(1992) may be irrelevant since no particular welfare gains could be expected from its implementation. Some institutionalized programs in order to help nations with structural problems may be welfare improving but, regarding the short term, the stabilizing role that can play the exchange rates could perfectly be played by wider and more automatic borrowing facilities for the governments that may need some help in case of a particular hard shock, and no specific insurance scheme seems to be needed. A second conclusion is that markets in Europe seem to be open enough and that no significant welfare gain can be expected from further development of financial links across the EU.

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Table 1: Correlation matrix of consumption series 1960-1990

	D	F	G	IR	IT	GR	LU	NE	PT	SP	UK
B	0.18	0.50	0.34	0.59	0.33	0.49	0.27	0.47	0.49	0.32	0.25
	(0.11)	(0.13)	(0.14)	(0.07)	(0.22)	(0.15)	(0.09)	(0.16)	(0.17)	(0.23)	(0.09)
D		0.25	0.25	0.13	-0.12	0.29	0.13	0.34	-0.29	0.01	0.23
		(0.12)	(0.10)	(0.12)	(0.13)	(0.14)	(0.07)	(0.14)	(0.12)	(0.13)	(0.10)
F			0.24	0.37	0.24	0.41	0.16	0.18	0.28	0.13	0.29
			(0.16)	(0.10)	(0.20)	(0.13)	(0.06)	(0.21)	(0.16)	(0.24)	(0.10)
G				0.42	0.10	0.36	0.45	0.69	-0.04	-0.04	0.07
				(0.09)	(0.19)	(0.12)	(0.07)	(0.10)	(0.19)	(0.23)	(0.09)
IR					0.18	0.30	0.11	0.45	0.21	0.28	0.29
					(0.14)	(0.11)	(0.06)	(0.09)	(0.16)	(0.12)	(0.08)
IT						0.55	0.06	0.45	0.34	0.50	0.14
						(0.20)	(0.06)	(0.22)	(0.17)	(0.12)	(0.08)
GR							0.01	0.61	0.01	0.46	0.14
							(0.06)	(0.14)	(0.18)	(0.13)	(0.09)
LU								0.31	0.15	0.19	0.11
								(0.11)	(0.05)	(0.07)	(0.06)
NE									-0.02	0.30	0.17
									(0.18)	(0.22)	(0.09)
PT										0.13	0.06
										(0.15)	(0.09)
SP											0.28
											(0.08)

Table 2: Correlation matrix of consumption series with the aggregate

B	D	F	G	IR	IT	GR	LU	NE	PT	SP	UK
0.51	0.11	0.51	0.37	0.45	0.85	0.68	0.24	0.64	0.34	0.62	0.44
(0.30)	(0.46)	(0.36)	(0.40)	(0.42)	(0.11)	(0.17)	(0.45)	(0.23)	(0.43)	(0.28)	(0.44)
0.74	0.37	0.63	0.33	0.60	0.79	0.38	0.40	0.68	0.34	0.72	0.66
(0.07)	(0.11)	(0.06)	(0.08)	(0.06)	(0.12)	(0.09)	(0.07)	(0.13)	(0.12)	(0.16)	(0.14)

Note:the first row corresponds to the whole sample 1960-1990. The second row to the subsample 1973-1990. Newey-West standard errors in brackets.

Table 3: Regression results

Country	USC		USG		USi		OILP	
B	0.41	0.05	0.44	-0.02	0.90	-0.24	0.89	-0.14
	(0.13)	(0.12)	(0.14)	(0.10)	(0.07)	(0.05)	(0.08)	(0.04)
	3.08	0.37	3.10	-0.17	13.85	-5.29	11.39	-3.58
	-4.43	-7.78	-4.01	-9.95	-1.52	-27.42	-1.45	-28.31
D	-0.04	0.47	-0.02	0.24	0.33	0.86	0.41	0.44
	(0.15)	(0.14)	(0.18)	(0.13)	(0.28)	(0.20)	(0.22)	(0.12)
	-0.25	3.34	-0.13	1.79	1.17	4.31	1.85	3.80
	-6.85	-3.76	-5.68	-5.75	-2.37	-0.72	-2.65	-4.77
F	0.33	0.18	0.36	0.05	0.70	-0.05	0.66	0.01
	(0.17)	(0.15)	(0.18)	(0.13)	(0.20)	(0.12)	(0.21)	(0.10)
	1.91	1.22	1.96	0.37	3.53	-0.41	3.15	0.14
	-3.88	-5.46	-3.47	-7.57	-1.54	-8.46	-1.63	-10.03
G	0.13	0.23	0.15	0.08	0.06	0.24	0.04	0.19
	(0.19)	(0.16)	(0.20)	(0.14)	(0.10)	(0.07)	(0.07)	(0.03)
	0.71	1.40	0.76	0.55	0.57	3.54	0.63	5.59
	-4.69	-4.74	-4.17	-6.58	-9.33	-11.10	-14.28	-23.93
IT	0.59	0.22	0.45	0.35	1.29	0.19	1.07	0.48
	(0.18)	(0.16)	(0.18)	(0.13)	(0.17)	(0.12)	(0.21)	(0.11)
	3.32	1.34	2.43	2.63	7.56	1.58	5.04	4.30
	-2.31	-4.73	-2.99	-4.79	1.71	-6.76	0.34	-4.68
IR	2.67	-0.02	2.19	0.45	2.00	-0.49	1.96	-0.31
	(2.06)	(1.10)	(2.04)	(0.86)	(0.62)	(0.33)	(0.71)	(0.28)
	1.30	-0.02	1.08	0.52	3.21	-1.48	2.77	-1.13
	0.81	-0.92	0.59	-0.64	1.60	-4.50	1.36	-4.71
GR	0.86	0.19	0.82	0.18	0.37	0.47	0.36	0.34
	(0.19)	(0.17)	(0.20)	(0.15)	(0.23)	(0.16)	(0.20)	(0.10)
	4.49	1.11	4.03	1.23	1.65	2.95	1.79	3.22
	-0.71	-4.63	-0.89	-5.65	-2.79	-3.39	-3.21	-6.35
LU	0.31	-0.07	0.33	-0.07	0.72	-0.07	0.72	-0.05
	(0.13)	(0.12)	(0.14)	(0.10)	(0.13)	(0.09)	(0.12)	(0.07)
	2.38	-0.58	2.41	-0.68	5.58	-0.81	5.78	-0.69
	-5.17	-8.67	-4.85	-10.54	-2.18	-11.71	-2.30	-15.90
NE	0.79	0.03	0.81	-0.01	0.75	0.26	0.75	0.17
	(0.22)	(0.20)	(0.23)	(0.17)	(0.29)	(0.20)	(0.28)	(0.14)
	3.56	0.17	3.44	-0.07	2.54	1.26	2.70	1.24
	-0.96	-4.85	-0.83	-6.07	-0.86	-3.69	-0.92	-5.84
PT	0.54	-0.11	0.63	-0.20	1.09	-0.78	1.00	-0.43
	(0.29)	(0.27)	(0.31)	(0.22)	(0.72)	(0.50)	(0.68)	(0.35)
	1.88	-0.43	2.05	-0.91	1.52	-1.57	1.49	-1.22
	-1.59	-4.20	-1.20	-5.40	0.12	-3.58	0.01	-4.07
SP	1.12	-0.33	0.88	0.15	1.14	0.09	1.16	0.03
	(0.22)	(0.18)	(0.23)	(0.15)	(0.43)	(0.26)	(0.43)	(0.20)
	5.04	-1.80	3.83	0.99	2.68	0.36	2.69	0.17
	0.54	-7.23	-0.53	-5.69	0.34	-3.44	0.38	-4.85
UK	0.23	0.31	0.19	0.22	0.79	0.41	0.79	0.24
	(0.12)	(0.10)	(0.13)	(0.09)	(0.28)	(0.16)	(0.34)	(0.15)
	1.93	2.98	1.44	2.47	2.78	2.47	2.34	1.64
	-6.34	-6.62	-6.02	-8.52	-0.74	-3.60	-0.61	-5.17

Note:The first row is the parameter estimate, the second is the standard error, the third the t-statistic for the hypothesis $\beta = 0$ and the fourth for the hypothesis $\beta = 1$

Table 4: Regression results

Country	POP		INF		INC		GOV	
B	0.71	-2.70	0.42	-0.15	0.29	0.30	0.37	0.16
	(0.16)	(1.35)	(0.14)	(0.12)	(0.09)	(0.06)	(0.11)	(0.06)
	4.38	-2.00	2.90	-1.25	3.25	4.64	3.38	2.67
	-1.75	-2.74	-4.05	-9.58	-8.06	-11.08	-5.74	-13.63
D	0.61	-4.72	0.16	-0.04	-0.17	0.68	0.45	-0.26
	(0.35)	(2.52)	(0.16)	(0.13)	(0.11)	(0.09)	(0.26)	(0.14)
	1.75	-1.87	0.98	-0.34	-1.54	7.60	1.71	-1.89
	-1.11	-2.27	-5.30	-8.04	-10.50	-3.50	-2.11	-9.14
F	0.31	3.96	0.48	-0.10	0.25	0.41	0.56	-0.06
	(0.09)	(0.89)	(0.17)	(0.11)	(0.08)	(0.06)	(0.16)	(0.08)
	3.53	4.44	2.82	-0.95	3.31	7.42	3.42	-0.74
	-7.68	3.32	-3.10	-10.39	-9.92	-10.61	-2.65	-13.20
G	0.43	-0.95	0.25	-0.36	0.02	0.41	0.19	0.16
	(0.24)	(1.06)	(0.23)	(0.26)	(0.15)	(0.10)	(0.13)	(0.07)
	1.79	-0.89	1.09	-1.35	0.11	4.23	1.50	2.34
	-2.41	-1.84	-3.28	-5.15	-6.45	-5.98	-6.32	-12.52
IR	2.88	0.90	3.26	0.27	2.86	-0.11	2.91	-0.15
	(0.31)	(1.11)	(0.43)	(0.19)	(0.30)	(0.16)	(0.34)	(0.12)
	9.33	0.81	7.58	1.42	9.63	-0.69	8.46	-1.25
	6.10	-0.09	5.26	-3.93	6.26	-6.91	5.55	-9.49
IT	1.67	-1.12	1.25	-0.16	1.37	0.09	1.43	0.08
	(0.21)	(1.37)	(0.35)	(0.10)	(0.34)	(0.09)	(0.34)	(0.07)
	7.84	-0.81	3.59	-1.66	4.05	1.03	4.20	1.19
	3.15	-1.54	0.73	-12.13	1.10	-10.30	1.26	-13.89
GR	0.88	-0.50	0.34	-0.23	0.64	0.17	0.85	0.08
	(0.20)	(1.06)	(0.14)	(0.04)	(0.18)	(0.07)	(0.16)	(0.07)
	4.46	-0.47	2.50	-5.27	3.57	2.58	5.24	1.17
	-0.59	-1.42	-4.87	-28.42	-2.04	-12.25	-0.92	-13.24
LU	0.25	0.31	0.15	-0.20	0.33	-0.11	0.00	0.00
	(0.13)	(0.26)	(0.12)	(0.10)	(0.14)	(0.05)	0.00	0.00
	1.90	1.20	1.24	-1.96	2.37	-1.96	0.00	0.00
	-5.62	-2.65	-7.01	-11.65	-4.91	-20.32	0.00	0.00
NE	0.84	-0.34	0.82	0.16	0.45	0.45	0.52	0.30
	(0.31)	(2.29)	(0.17)	(0.14)	(0.20)	(0.15)	(0.14)	(0.08)
	2.72	-0.15	4.85	1.11	2.20	2.97	3.77	3.90
	-0.51	-0.58	-1.08	-6.03	-2.74	-3.64	-3.51	-9.09
PT	0.70	-0.86	0.10	-0.29	0.40	0.46	0.64	0.28
	(0.24)	(0.39)	(0.40)	(0.13)	(0.19)	(0.08)	(0.28)	(0.11)
	2.89	-2.18	0.26	-2.23	2.13	5.82	2.29	2.60
	-1.26	-4.71	-2.27	-9.91	-3.20	-6.85	-1.31	-6.85
SP	0.86	-2.29	0.56	-0.23	0.56	0.19	0.68	0.07
	(0.24)	(1.51)	(0.13)	(0.06)	(0.18)	(0.08)	(0.24)	(0.10)
	3.63	-1.51	4.27	-3.79	3.10	2.55	2.87	0.73
	-0.61	-2.17	-3.38	-20.60	-2.40	-10.62	-1.34	-9.21
UK	0.44	-1.65	0.12	-0.22	0.22	0.19	0.37	-0.04
	(0.16)	(1.48)	(0.17)	(0.08)	(0.15)	(0.08)	(0.13)	(0.05)
	2.77	-1.11	0.72	-2.84	1.50	2.55	2.90	-0.86
	-3.47	-1.79	-5.09	-15.80	-5.30	-10.74	-5.04	-20.67

Note:The first row is the parameter estimate, the second is the standard error, the third the t-statistic for the hypothesis $\beta = 0$ and the fourth for the hypothesis $\beta = 1$

Table 5: F-tests results for external variables.

	1960-1990				1972-1990			
	USC	USG	USi	Oil P	USC	USG	USi	Oil P
B	10.39	10.29	11.71	11.25	1.73*	1.12*	0.53*	1.58*
D	8.95	6.92	6.61	11.01	6.94	2.86*	2.09 *	6.09
F	5.73	5.01	4.97	4.95	0.52*	0.63*	0.78*	0.51*
G	8.16	7.19	7.05	7.03	8.13	8.29	6.11	6.12
IR	1.14*	2.26*	7.02	0.76*	0.59*	3.06*	6.53	0.44*
IT	1.24*	1.72*	1.94*	1.26*	2.65*	2.06*	3.89	2.09*
GR	0.55*	0.67*	0.08*	0.53*	3.48	3.21*	0.59*	1.17*
LU	4.98	5.00	4.91	5.18	1.16*	1.13*	1.10*	1.27*
NE	0.48*	0.47*	0.66*	0.47*	1.82*	1.56*	1.08*	0.60*
PT	1.27*	1.53*	1.55*	1.20*	3.24*	1.81*	0.73*	0.35*
SP	0.57*	0.17*	0.01*	0.05*	0.81*	0.66*	0.91*	0.56*
UK	4.88	4.53	3.76	5.72	1.71*	1.08*	0.02*	2.39*

Note: c.v 3.88. * indicates acceptance of the hypothesis of nonsignificancy of parameters

Table 6: F-tests results for idiosyncratic variables.

	1960-1990				1972-1990			
	POP	INF	INC	GOV	POP	INF	INC	GOV
B	11.73	9.67	17.99	12.72	1.84*	2.98*	6.30	5.83
D	7.51	4.94	13.98	6.72	1.87*	1.41*	5.39	5.05
F	4.68	3.11*	7.93	3.04*	5.13	0.71*	1.17*	2.92*
G	5.48	6.49	11.74	6.22	2.82*	4.61	6.42	2.84*
IR	13.74	14.82	13.58	14.79	8.06	4.56	15.53	3.94
IT	1.06*	1.69*	1.21*	1.41*	0.64*	1.40*	0.74*	2.07*
GR	0.18*	2.53*	1.78*	0.46*	0.16*	2.40*	1.94*	0.33*
LU	4.99	5.20	5.58		1.71*	1.81*	5.48	
NE	0.39*	0.76*	3.44	2.98*	0.27*	2.11*	0.66*	2.26*
PT	2.06*	3.29*	10.48	3.79	2.69*	7.36	18.02	5.91
SP	1.87*	3.15*	2.73*	0.90*	1.49*	6.66	3.45	0.63*
UK	3.26*	4.96	4.26	3.16*	0.05*	2.27*	0.54*	0.37*

Note: c.v 3.88. * indicates acceptance of the hypothesis of nonsignificancy of parameters

Table 7: Variance Decomposition

		USC	USG	USi	OP		POP	INF	INC	GOV
EU	0.58	0.07	0.06	0.13	0.16	0.71	0.10	0.04	0.03	0.13
B	0.57	0.10	0.17	0.10	0.07	0.76	0.11	0.04	0.06	0.03
D	0.52	0.26	0.02	0.08	0.12	0.74	0.00	0.19	0.03	0.03
F	0.78	0.01	0.02	0.17	0.01	0.59	0.02	0.01	0.30	0.07
G	0.68	0.03	0.18	0.08	0.02	0.83	0.08	0.02	0.04	0.02
IR	0.63	0.15	0.03	0.13	0.06	0.30	0.19	0.09	0.16	0.27
IT	0.53	0.06	0.11	0.09	0.21	0.67	0.09	0.04	0.14	0.05
GR	0.62	0.06	0.04	0.15	0.14	0.58	0.03	0.04	0.23	0.12
LU	0.61	0.05	0.12	0.07	0.15	0.89	0.05	0.03	0.03	0.00
NE	0.58	0.14	0.06	0.12	0.11	0.71	0.03	0.16	0.02	0.08
PT	0.83	0.04	0.04	0.03	0.05	0.66	0.15	0.05	0.00	0.13
SP	0.45	0.12	0.11	0.17	0.15	0.96	0.02	0.02	0.01	0.00
UK	0.62	0.11	0.13	0.07	0.07	0.71	0.07	0.11	0.03	0.08

Note: The values indicate the percentage of variance after 10 periods that is explained by each variable. The first and sixth column indicate the percentage of variance not affected by the exogenous variables

Table 8: GRANGER CAUSALITY TEST.

	USC	USG	USi	OILP	Block
EU	0.43	4.04	1.12	2.65	18.66
B	5.63	10.07	3.77	0.89	18.08
D	7.65	3.04	6.59	10.49	28.10
F	1.35	4.60	7.38	1.28	10.88
G	13.96	8.81	2.88	0.01	20.72
IR	5.87	0.84	2.84	1.12	27.74
IT	6.47	7.57	1.02	2.93	44.58
GR	7.27	8.07	16.25	7.50	22.41
LU	1.99	3.17	6.78	8.04	18.50
NE	8.95	3.83	0.08	4.90	23.99
PT	2.72	3.59	0.55	2.53	9.32
SP	14.55	10.58	8.58	8.71	37.51
UK	4.65	4.27	1.03	3.67	18.66
	POP	INF	INC	GOV	Block
EU	1.99	1.98	1.84	4.94	9.50
B	0.34	1.57	6.12	0.65	12.25
D	0.12	7.57	1.90	2.09	16.67
F	12.61	23.19	9.10	4.08	39.89
G	1.85	3.45	2.94	0.51	7.81
IR	20.08	4.59	53.98	33.02	90.47
IT	6.25	5.21	5.08	4.75	10.44
GR	4.27	27.57	35.32	6.48	19.41
LU	0.92	1.14	1.28	0.00	6.62
NE	3.78	6.94	0.26	3.64	13.37
PT	5.81	4.24	3.21	2.14	18.15
SP	0.20	1.11	0.04	0.07	1.36
UK	0.37	3.16	2.08	4.33	16.86

Note:Individual test c.v.5.99. Block test c.v.:15.51

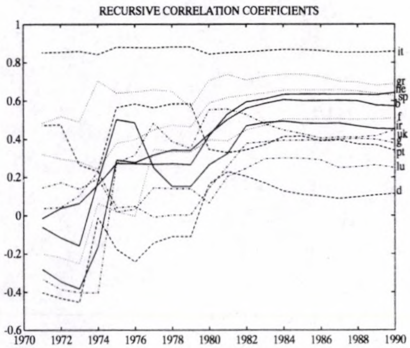

Figure 1: Recursive correlation coefficents

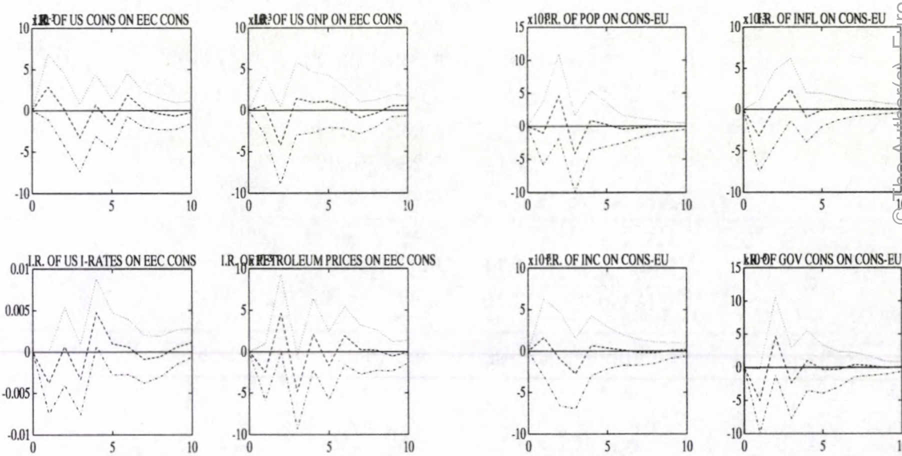

Figure 2: Impulse responses of EU to external and idiosyncratic shocks

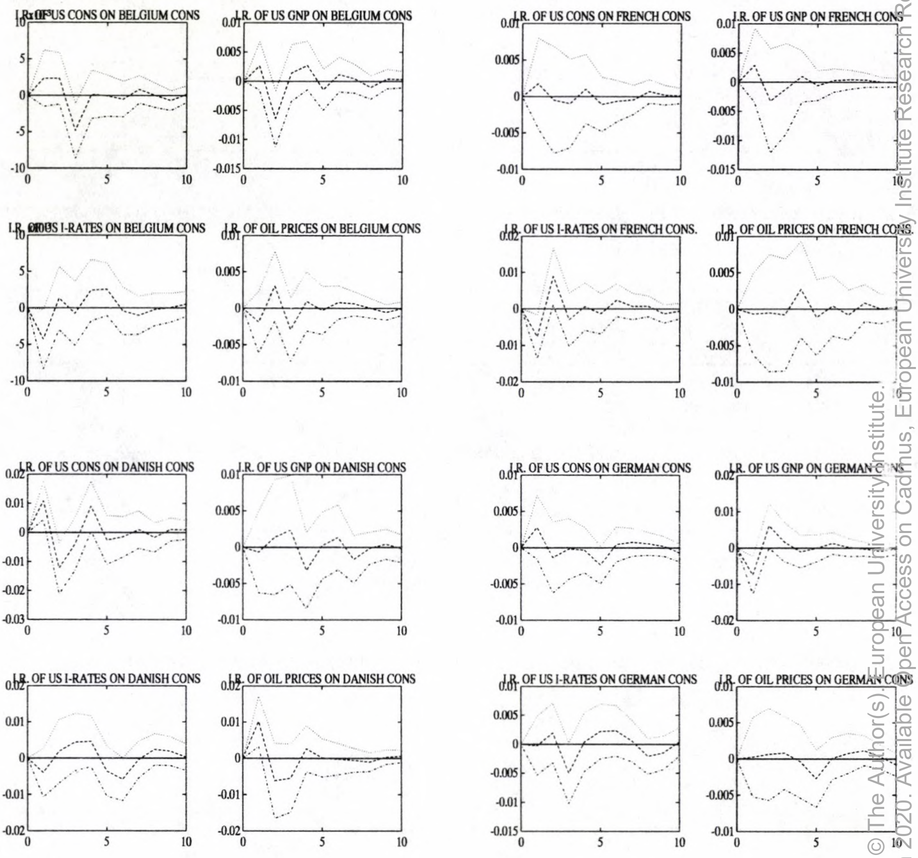

Figure 3: Impulse responses of EU countries to common external shocks

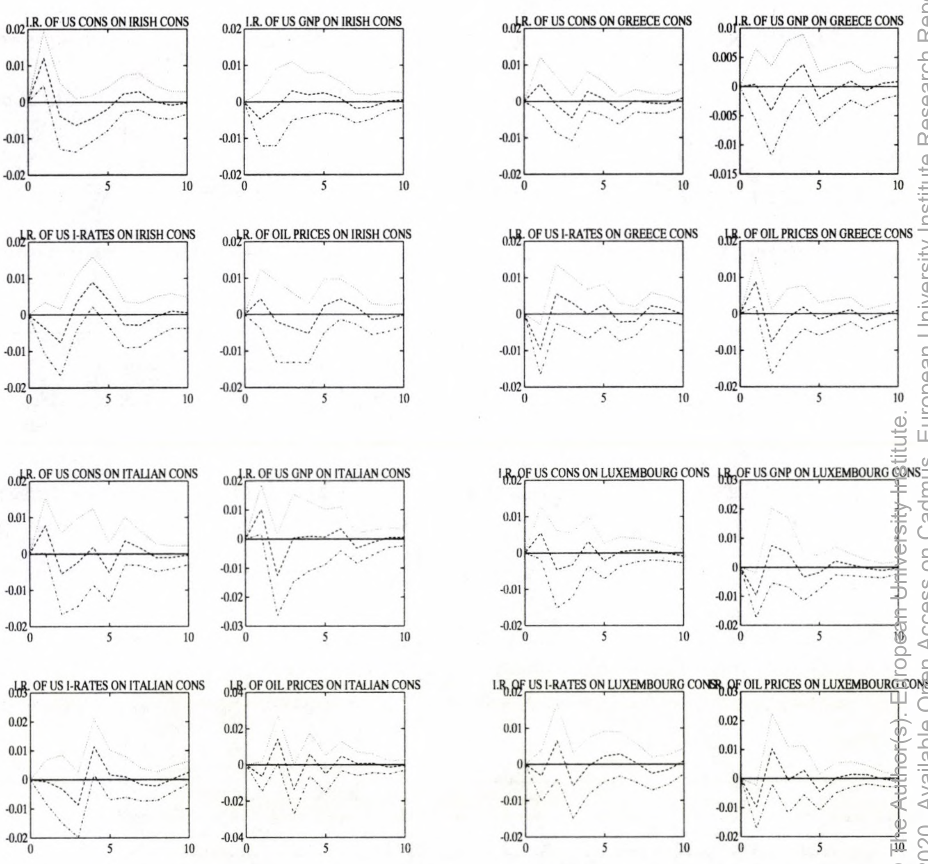

Figure 4: Impulse responses of EU countries to common external shocks

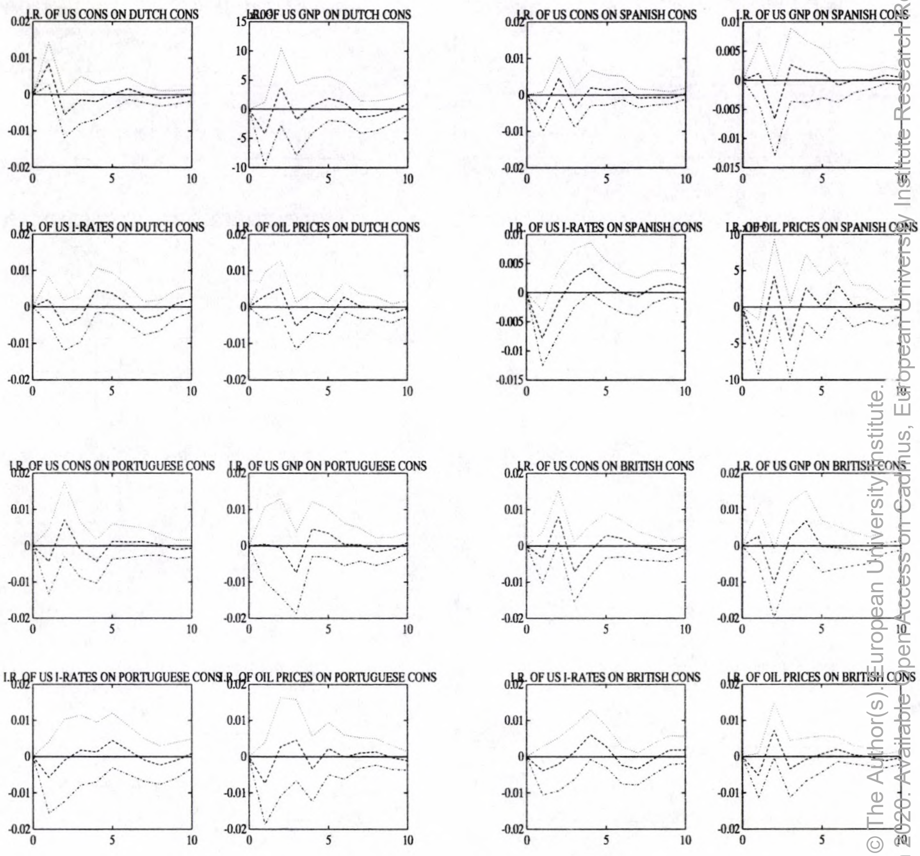

Figure 5: Impulse responses of EU countries to common external shocks

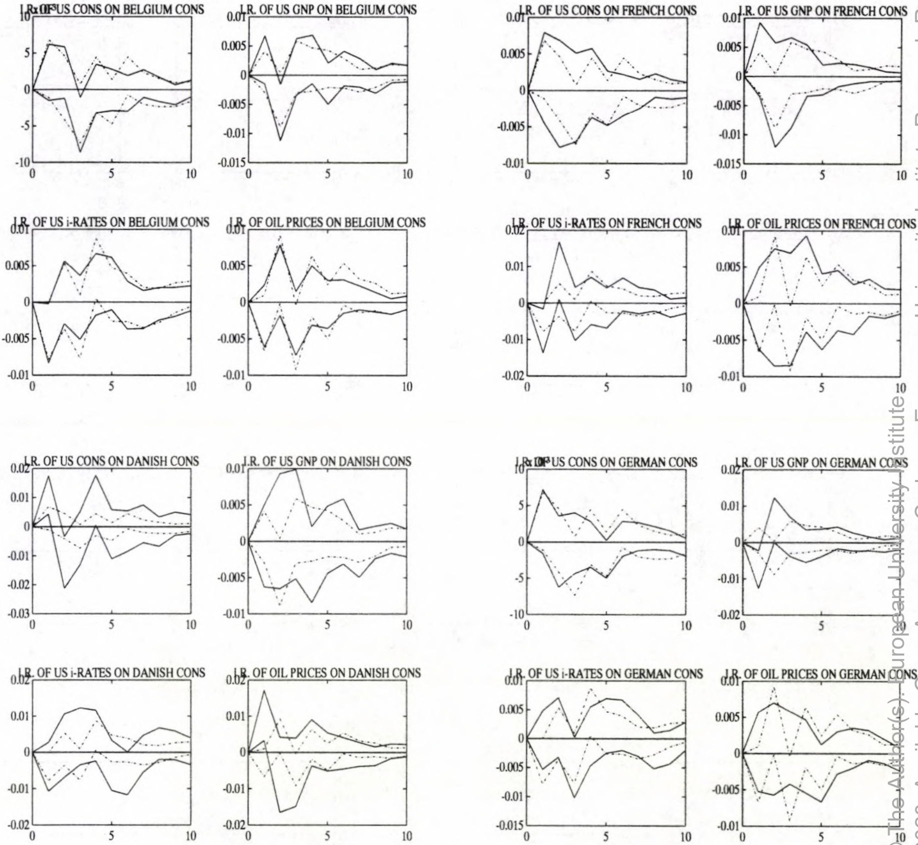

Figure 6: S.E bands of EU and each country responses to common shocks

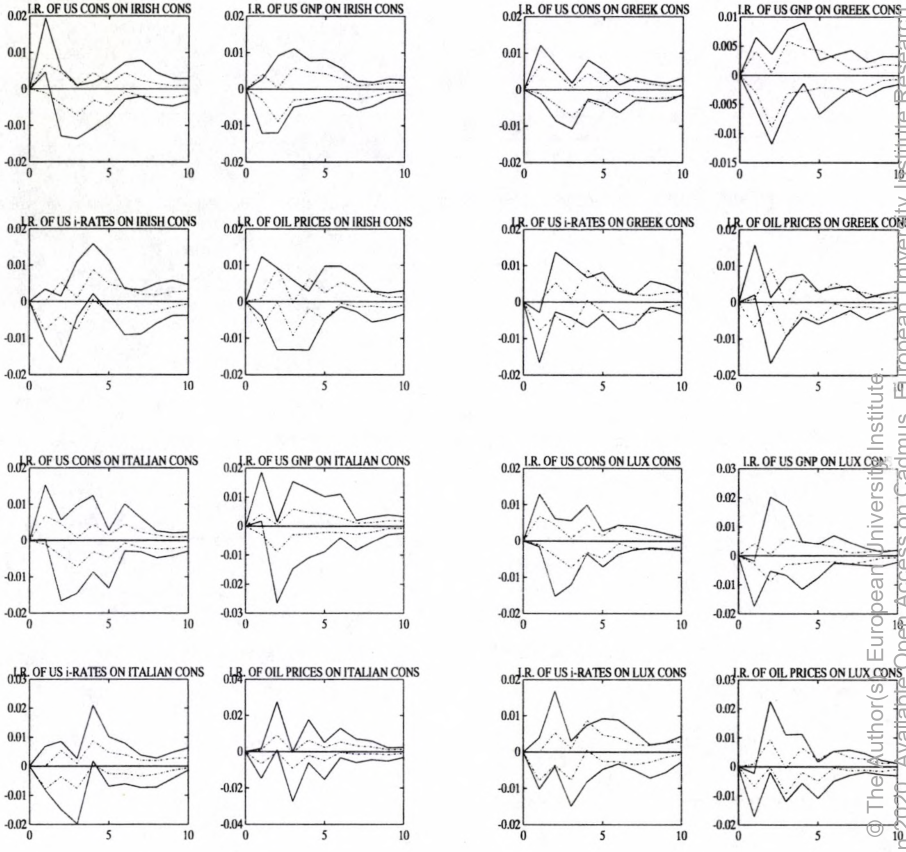

Figure 7: S.E bands of EU and each country responses to common shocks

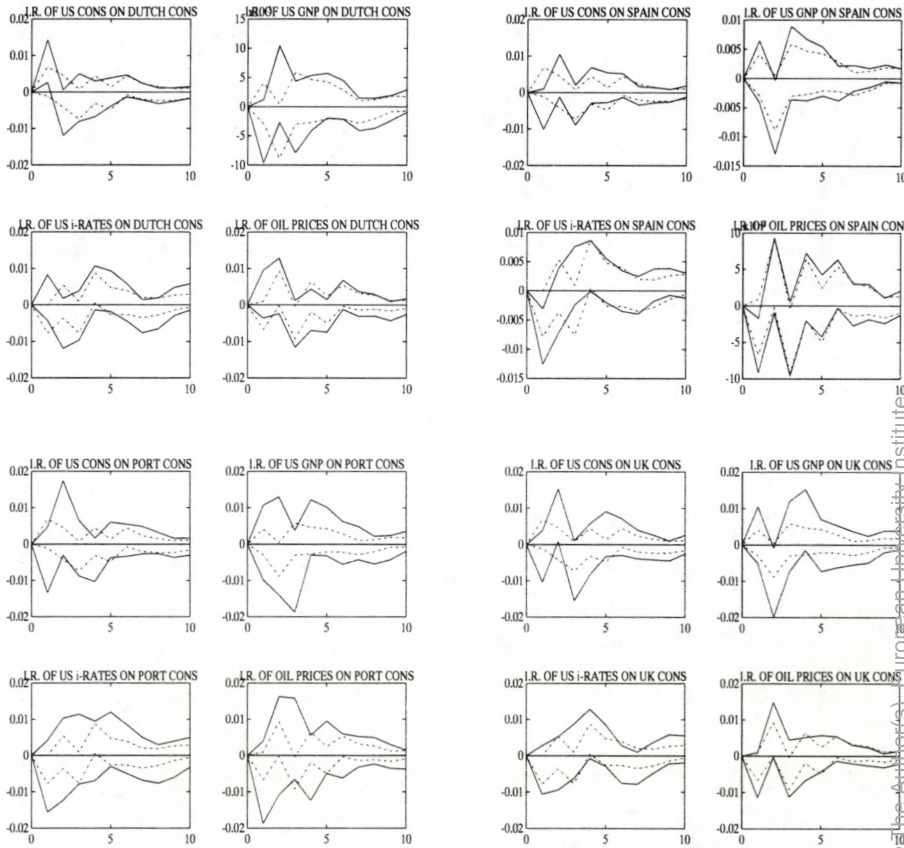

Figure 8: S.E bands of EU and each country responses to common shocks

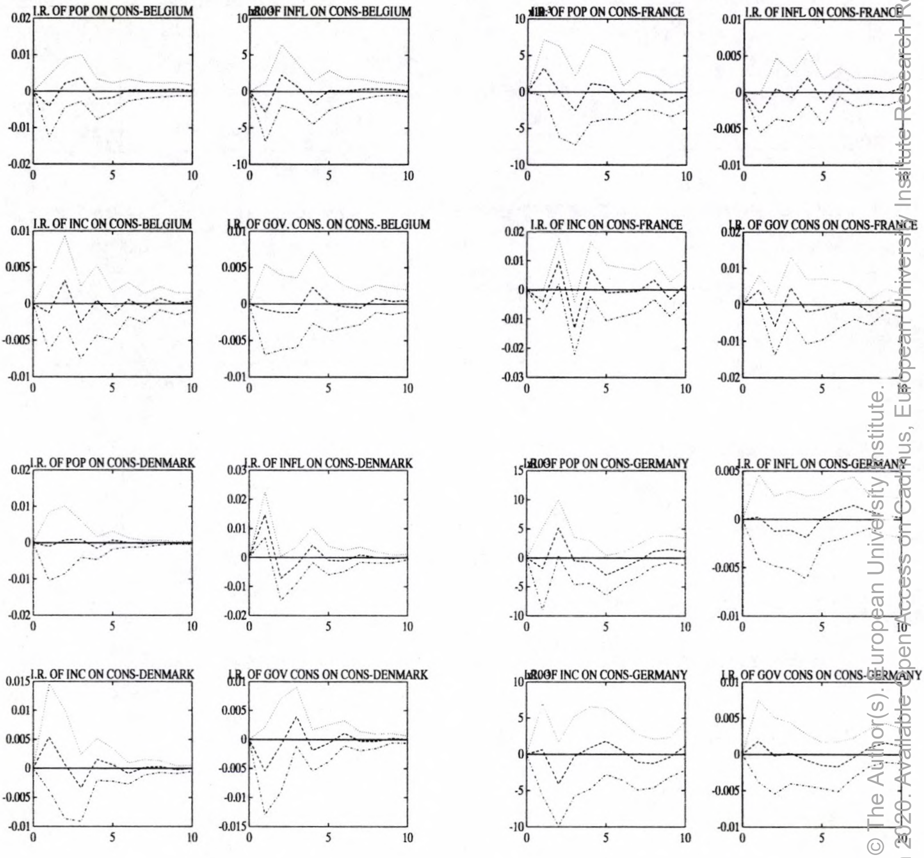

Figure 9: Impulse responses of EU countries to idiosyncratic shocks

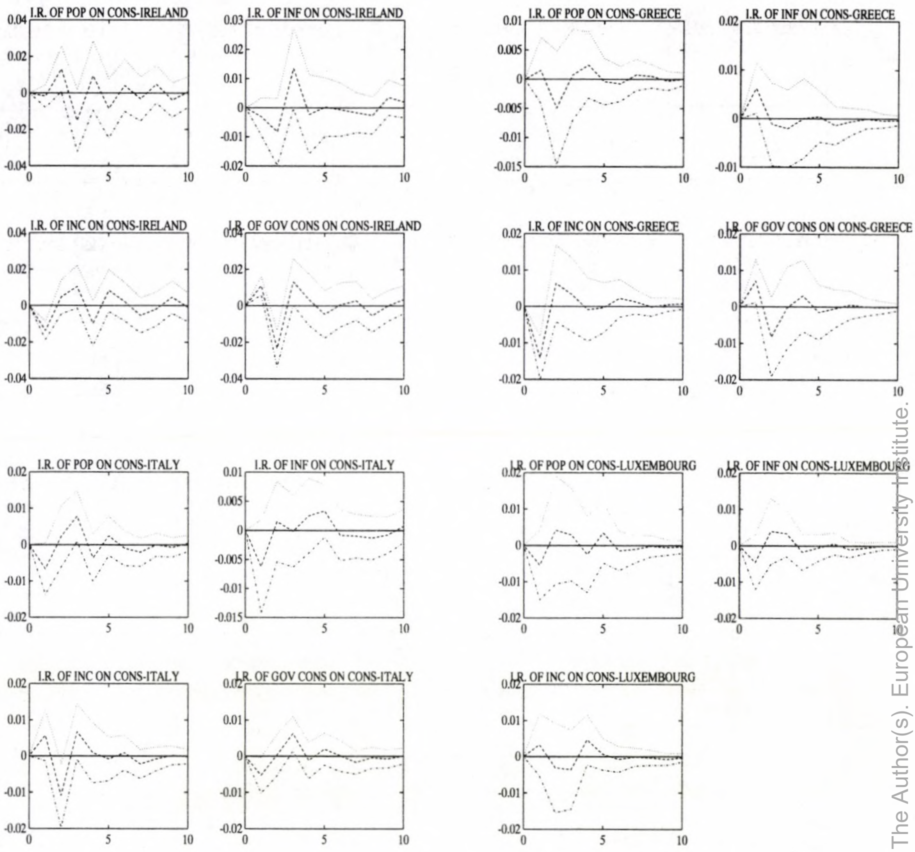

Figure 10: Impulse responses of EU countries to idiosyncratic shocks

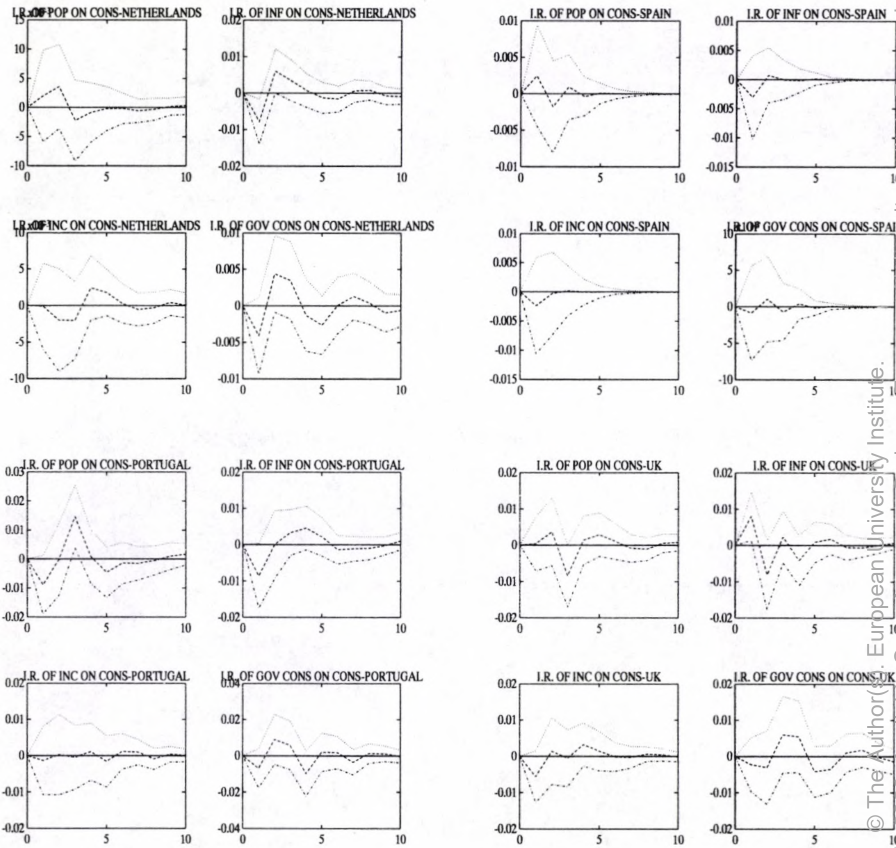

Figure 11: Impulse responses of EU countries to idiosyncratic shocks

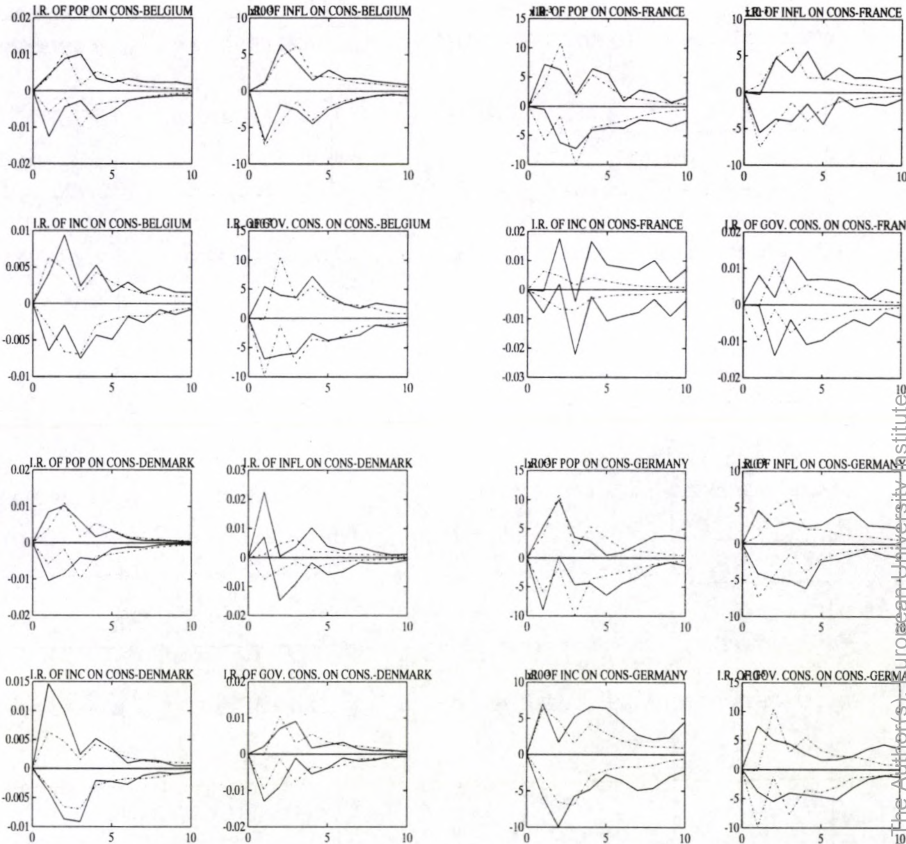

Figure 12: S.E bands of EU and each country responses to idiosyncratic shocks

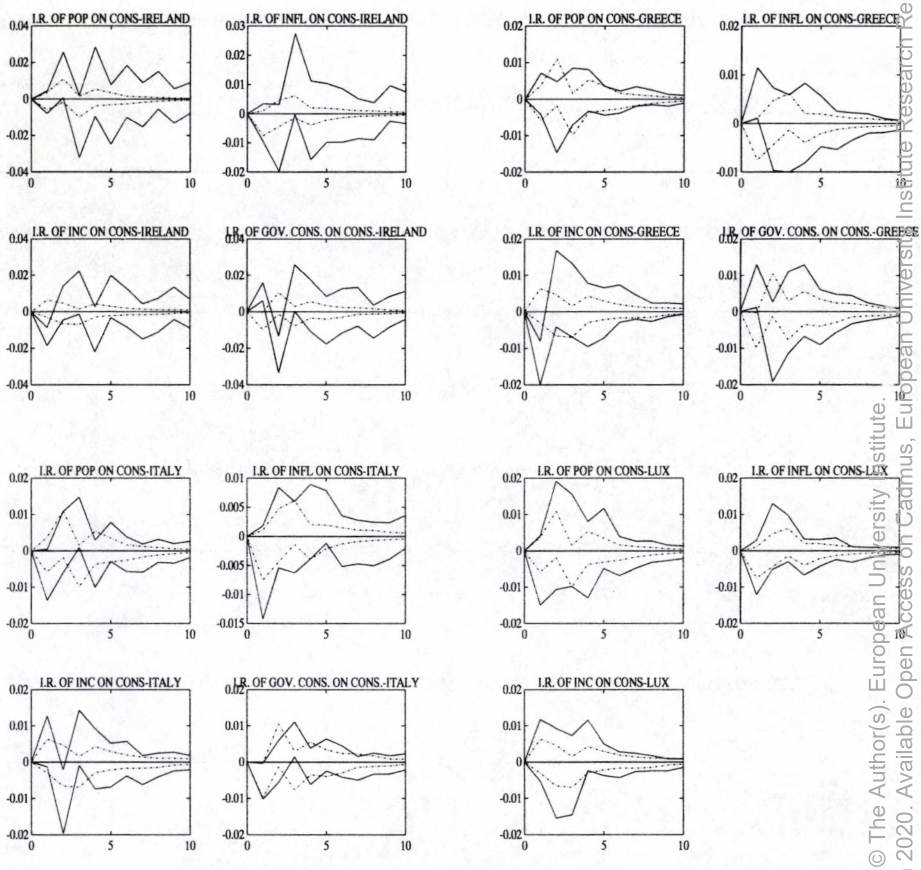

Figure 13: S.E bands of EU and each country responses to idiosyncratic shocks

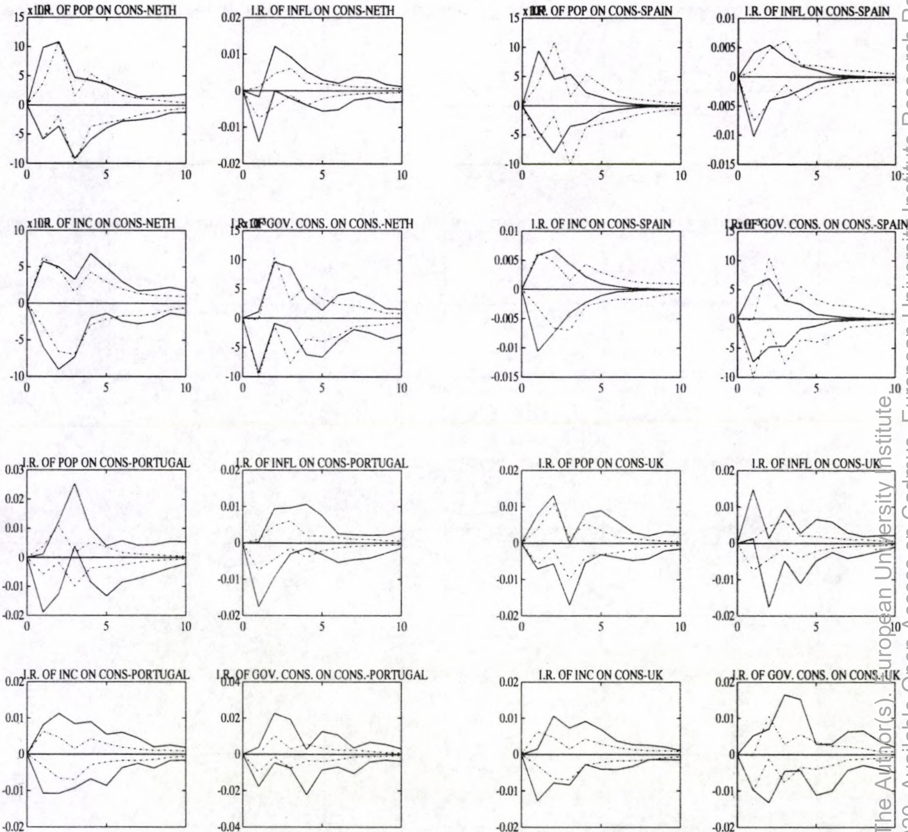

Figure 14: S.E bands of EU and each country responses to idiosyncratic shocks

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